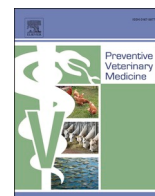


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## Preventive Veterinary Medicine

journal homepage: [www.elsevier.com/locate/prevetmed](https://www.elsevier.com/locate/prevetmed)Application of the World Café method to discuss the efficiency of African swine fever control strategies in European wild boar (*Sus scrofa*) populationsF. Jori<sup>a,b,1,\*</sup>, E. Chenais<sup>c,1</sup>, F. Boinas<sup>d</sup>, P. Busauskas<sup>e</sup>, S. Dholllander<sup>f</sup>, L. Fleischmann<sup>g</sup>, E. Olsevskis<sup>h</sup>, J.M. Rijks<sup>i</sup>, K. Schulz<sup>j</sup>, H.H. Thulke<sup>k</sup>, A. Viltrop<sup>l</sup>, K. Stahl<sup>c</sup><sup>a</sup> CIRAD, UMR ASTRE (Animal, Health, Territories, Risks and Ecosystems), F-34398 Montpellier, France<sup>b</sup> ASTRE, Univ Montpellier, CIRAD, INRAE, F-34398, Montpellier, France<sup>c</sup> National Veterinary Institute, Uppsala, Sweden<sup>d</sup> CIISA – Centro de Investigação Interdisciplinar em Sanidade Animal, Faculdade de Medicina Veterinária, Universidade de Lisboa, Avenida da Universidade Técnica, 1300-477 Lisboa, Portugal<sup>e</sup> Emergency Response Department, State Food and Veterinary Service, Vilnius, Lithuania<sup>f</sup> European Food Safety Agency, Parma, Italy<sup>g</sup> Department of Human Geography, Martin-Luther-Universität Halle-Wittenberg, Halle, Germany<sup>h</sup> Institute of Food Safety, Animal Health and Environment - "BIOR", Riga, Leļupes 3, Latvia<sup>i</sup> Dutch Wildlife Health Centre, Faculty of Veterinary Medicine, Utrecht University, the Netherlands<sup>j</sup> Institut für Epidemiologie, Friedrich-Loeffler-Institut, Bundesforschungsinstitut für Tiergesundheit, Federal Research Institute for Animal Health, 17493 Greifswald-Riems, Germany<sup>k</sup> Helmholtz Centre for Environmental Research GmbH – UFZ, Department of Ecological Modelling, PG EcoEpi, Leipzig, Germany<sup>l</sup> Estonian University of Life Science, Institute of Veterinary Medicine and Animal Sciences, Kreutzwaldi 62, 51014, Tartu, Estonia

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## ABSTRACT

In the current epidemic of African swine fever (ASF) in Europe, the maintenance and spread of the disease among wild boar populations remains the most important epidemiological challenge. Affected and at-risk countries have addressed this situation using a diversity of wild boar management methods with varying levels of success. The methods applied range from conventional animal disease intervention measures (zoning, stakeholder awareness campaigns, increased surveillance and biosecurity measures) to measures aimed at reducing wild boar population movements (fencing and baiting/feeding) or population numbers (intensive hunting). To assess the perceived efficiency and acceptance of such measures in the context of a focal introduction of ASF, the authors organised a participatory workshop inviting experts from the fields of wildlife management, wild boar ecology, sociology, epidemiology and animal disease management to discuss the advantages and disadvantages of various control approaches. The discussions between professionals from different countries took place using the World Café method. This paper documents the World Café method as a tool for increasing the level of participation in multi-stakeholder group discussions, and describes the outputs of the workshop pertaining to the control measures. In summary, the World Café method was perceived as an efficient tool for quickly grasping comprehensive perspectives from the professionals involved in managing ASF and wild boar populations, while promoting engagement in multi-disciplinary discussions. The exercise achieved a good overview of the perceived efficiency and applicability of the different control methods and generated useful recommendations for ASF control in wild boar populations in Europe.

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## 1. Introduction

African swine fever (ASF) of genotype II has been present in the European Union (EU) since 2014<sup>2</sup>. During these six years collective knowledge about ASF epidemiology and control in the European context has increased and many publications and reports have been produced (Chenais et al., 2019; Schulz et al., 2019; Dixon et al., 2020). The haemorrhagic viral disease affects domestic pigs and European wild boar (*Sus scrofa*), with clinical presentations varying from peracute to chronic disease and a case fatality rate of up to 100 % (Costard et al., 2009). If protected by organic material, the virus is very resistant and can remain infective for several months (Mebius et al., 1997). Upon direct contact with blood from infected pigs, the infectivity is fairly high (Gulenko et al., 2011), but between farms, or independent social groups formed by wild boar (sounders), the rate of transmission is quite low (Olševskis et al., 2016; Chenais et al., 2019; Schulz et al., 2019). These epidemiological characteristics are important when considering control of the disease in wild boar populations. In the current epidemic the virus is maintained within wild boar populations independently of domestic pigs (Chenais et al., 2018; EFSA Panel on Animal Health and Welfare (AHAW) et al., 2018a). This infectious cycle involving wild boar populations, wild boar carcasses and the habitat is known as the wild boar-habitat epidemiological cycle (Chenais et al., 2018). Infected wild boar carcasses, anthropogenic spread and hunting waste left in forests are recognised as the main drivers of transmission within and between wild boar populations (Morelle et al., 2019). Largely based on experience from the ASF-incursion in the Czech Republic, a recent scientific report recommends that following a focal introduction of ASF in wild boar, different areas should be created in which specific management measures aiming at control or eradication of ASF in wild boar populations can be applied (EFSA Panel on Animal Health and Welfare (AHAW) et al., 2018b). See Box 1 for a detailed description of these areas.

Current experience has shown that management of ASF in wild boar populations requires cooperation between specialists from a variety of disciplines. Indeed, the competences of veterinarians, epidemiologists, modellers, ecologists, hunters, wildlife specialists, as well as social and communication scientists are needed to improve ASF management, assess efficiency and acceptance of available control measures, and to generate innovative solutions. Discussion tools explicitly designed to foster interdisciplinarity and inclusive participation required to achieve such cooperation are currently used in various contexts. The World Café method is one such generic tool, methodologically included among participatory action research (Aldred, 2011; Steier et al., 2016) and specifically designed to facilitate multidisciplinary dialogue between participants with different scientific background, professional experience and geographical or cultural origins (MacFarlane et al., 2017).

With this in mind, the objectives of this study were: i) to document the use of the World Café method as a tool for increasing participation in multi-stakeholder discussions in the context of an animal health crisis, and ii) to gather knowledge concerning the control of ASF in wild boar populations and assess the efficiency and applicability of different control methods.

## 2. Material and methods

### 2.1. The World Café method

The World Café method is a flexible approach for facilitating group discussions that can be used to engage stakeholders and encourage participation while discussing a specific topic (Biondo et al., 2019). Initially conceived as a process for learning, planning and leading in the intersection between policy and practice, it has by now been used for

many other applications, including research prioritisation (MacFarlane et al., 2017), activity planning and elicitation of community group perspectives (Biondo et al., 2019), as well as in plant and public health programme evaluation and planning (MacLeod et al., 2016; MacFarlane et al., 2017; Silva and Guenther, 2018). It is considered a powerful conversational process that helps communities and other groups of people engage in constructive dialogues, build personal relationships and foster collaborative learning (Tan and Brown, 2005). A World Café discussion covers several topics (each with an assigned host or facilitator), that are discussed by small groups of participants rotating between the topics. Progress is strived for at each rotation, supported by the facilitator giving a short introduction at the start of each rotation to inform the new group about the input of the previous groups (Carson, 2011). In the original World Café format, special effort is made to encourage informal discussions, making participants feel at ease, and create a relaxed discussion environment resembling a café (Carson, 2011). In the present study, we applied the World Café method in the context of a workshop about the assessment of ASF control strategies in wild boar populations within EU countries. To our knowledge, this is the first publication on the use of the World Café method in the context of an international animal health crisis. In this manuscript we describe the application of an adopted version of the World Café method, summarise and assess the quality of the emerging results, and place the method in the framework of participatory action research from which the veterinary version of participatory epidemiology stems.

### 2.2. Study design and participant selection

The study was conducted in March 2019 at a two-day workshop of the ASF-STOP COST action ([www.asf-stop.com](http://www.asf-stop.com)), addressing control of ASF in wild boar populations in infected and at-risk countries. The first day of the workshop comprised scientific presentations to provide some background on different management methods applicable for the control of ASF in wild boar populations. The second day of the workshop consisted of the participatory exercise described here. Participants attended both days of the workshop, and were purposively selected by the study steering group (first, second and last authors) in order to obtain maximum diversity in terms of the disciplines and geographic origins represented. All participant costs related to the workshop were covered by the project. The group of participants encompassed 36 experts, including veterinarians, wild boar managers, hunters, epidemiologists, mathematical modellers and social scientists representing governments, national and international organisations, the hunting lobby and private industry. The proportion of the different disciplines is represented in Fig. 1.

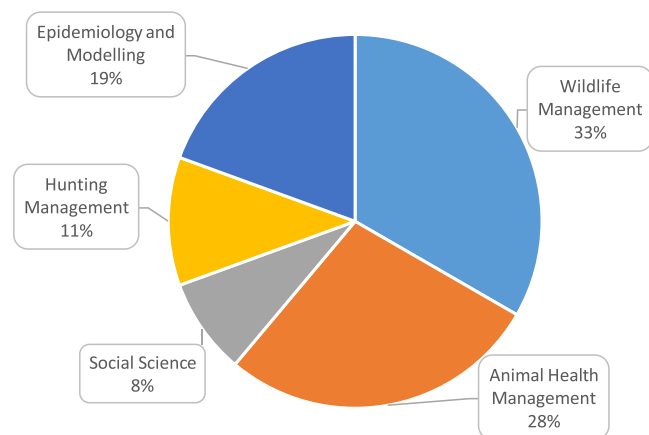
On the second day of the workshop, the World Café method was used to discuss six methods to improve control of ASF in wild boar populations: a) stakeholder engagement and public awareness, b) fencing, c) passive surveillance, d) manipulation of the carrying capacity of wild boar habitats, e) hunting management, and f) other population control methods (e.g. poisoning, fertility control). These methods were identified by the study steering group based on previous discussions and meetings within the framework of the ASF-STOP COST action, EFSA reports and scientific opinions, as well as field experience from the current epidemic. Some aspects of these topics were explored during the presentations given on the previous day. In addition, the terms and concepts needed for the discussions were defined at the start of each World Café rotation (see Table 1). The participants were asked to assess the feasibility, efficacy and constraints of each method in the context of a focal introduction. For each discussion topic (related to a specific ASF control method), a facilitator was selected by the steering group. The selection was based on area of expertise, interest in the World Café method or participatory approaches, and perceived facilitation skills. The request to act as facilitator was done a few days prior to the workshop and none of the facilitators were involved in the selection of participants. The steering group remained as overall observers in order

<sup>2</sup> [https://ec.europa.eu/food/animals/animal-diseases/not-system\\_en](https://ec.europa.eu/food/animals/animal-diseases/not-system_en).

**Box 1**

Areas to be established following a focal introduction of ASF in wild boar, according to the EFSA Panel on Animal Health and Welfare (2018b).

The core area refers to the smallest circle around all detected ASF-positive carcasses. In this area, public access and hunting activities should be restricted to keep the wild boar populations undisturbed. The buffer area surrounds the core area and should be several times larger than the size of wild boar home range (which depends on the local landscape and habitat conditions). As with the core area, wild boar populations in this area should initially be kept undisturbed. After a certain waiting time, the core and buffer areas are to be depopulated. In an intensive hunting area surrounding the buffer area, the aim is immediate preventive reduction of population numbers in order to provide unfavourable conditions for ASF spread in the event that infected wild boar leave the core or buffer areas. In the intensive hunting area, hunting activities need to be carried out at a high biosecurity level and hunting procedures that minimise the disturbance of wild boar should be used. In all areas, passive surveillance activities should be carried out, including the active search and removal of carcasses.



**Fig. 1.** Proportions of the different disciplines represented among the World Café participants (n = 36).

**Table 1**

Definitions of terms used during the World Café discussions.

Term	Definition
Stakeholder communication	Communication between stakeholders directly involved in control measures, such as authorities and hunters, but also transparent communication of information to the general public
Passive surveillance	Observer-initiated provision of animal health-related data (e.g. voluntary notification of suspected disease) or use of existing data for surveillance <sup>1</sup>
Carrying capacity	Carrying capacity, the average population density or population size of a species below which its numbers tend to increase and above which its numbers tend to decrease because of shortages of particular food, shelter, and social requirements <sup>2</sup> .
Poisoning	Oral administration (through baits) of a toxic substance that causes quick death without suffering

<sup>1</sup>RISK SUR <https://www.fp7-risksur.eu/terminology/glossary#group-P>.

<sup>2</sup>Encyclopaedia Britannica <https://www.britannica.com/science/carrying-capacity>.

to document and supervise the exercise and did not facilitate nor contribute to the group discussions. Participants were divided into six groups of five to six persons each, making sure that groups were as diverse as possible regarding the professional background of the participants. The topics were discussed around tables, with one table dedicated to each topic. The facilitator stayed at the table, while the groups rotated. Each table was equipped with flipcharts, pens and other materials for taking notes. Each group spent 20–30 min at each table before rotating. The facilitators collected the information and gave a summary of the previous discussions to each new group arriving, making sure that the discussions progressed with each group. When all groups had visited all tables, the facilitators were given 30 min to summarise

and organise the notes before presenting the results to all the participants.

After the workshop, the facilitators summarised the discussions in a written report (available on the project's website) and evaluated the discussions concerning their respective topic for dissensus, consensus and saturation. The reports from the facilitators were further shortened and adopted to fit the publication format. What is presented in the result section regarding “Methods for improving control of ASF in wild boar populations” is thus the authors' summary of the facilitators' summaries of the discussions. Dissensus was considered to be present if the topic seemed to provoke debate and heated discussions, or if strong disagreements or opposing positions were detected within or between groups. Consensus was considered to be present when there was a general feeling of agreement and similarity in opinions within and between groups. Saturation was assessed based on whether new concepts or ideas were still emerging during the last rotation. The World Café method was evaluated as a tool for stimulating participation in multi-stakeholder discussions based on i) direct observation of the process, ii) informal interviews with participants and facilitators, and iii) the quality of the results emerging from the discussions. The evaluation of the quality of the emerging results was based on the assumption that increased participation and interdisciplinary communication will create outputs of higher quality, and grounded in the authors' previous expert knowledge of the topics as well as experience from other forms of group discussions (e.g. in the framework of the ASF-STOP COST action).

### 3. Results

The results regarding the qualitative assessment of the perceived efficiency and applicability of the control methods are summarised here per discussion topic, followed by the results pertaining to the evaluation of the World Café method.

#### 3.1. Methods for improving control of ASF in wild boar populations

##### 3.1.1. Stakeholder engagement and public awareness

There was consensus between all groups on the need to engage with a large panel of stakeholders. The diversity of the stakeholders was considered important per se and a non-exhaustive list of potential stakeholders was identified (see Table 2). All groups agreed that it is essential to engage in discussions with different stakeholder groups at an early stage and that stakeholders should be identified during the contingency planning process. To engage more efficiently with stakeholders, the participants considered the importance of understanding stakeholder motivations (for instance financial incentives, social acceptance, or political visibility) and identify their leverages. During an outbreak, the information flow within the veterinary sector managing notifiable diseases is top down from central decision-making level to local level. Since stakeholders on the local level need to implement the actions decided at the top level, a dialogue regarding the practical implementation of measures needs to be developed. In the context of

**Table 2**

List of stakeholders with whom to engage in the event of focal introduction of ASF among wild boar populations (non-exhaustive list), according to World Café discussions concerning “Stakeholder engagement and public awareness”.

Sector	Stakeholders
Pig sector	Commercial pig farmers Backyard pig farmers Pig farmer associations Pig feed producers Pig transport enterprises Pig waste transformers Rendering plants
Animal health services	Animal health authorities (official veterinarians) Private veterinarians Diagnostic laboratories
Forest, fish, wildlife and nature exploitation	Foresters, wood industry
	Volunteer rangers Fisheries Hunters and their associations Mushroom/berry pickers Conservationists Bird watchers Hikers
Forestry services	Forestry/nature ministries Forestry rangers Wildlife managers/rangers
Civil service	Government/politicians Provinces Municipalities Army Police Border inspection posts
Other	Linear infrastructure managers (road maintenance) Lorry drivers Local farmers General public, e.g., dog walkers, local inhabitants Animal welfare associations Journalists and media (TV, radio for society) Scientists Citizen scientists Tourism agencies City people

ASF, risk communication further needs to be directed to the general public. The latter was considered instrumental as an uninformed public can adopt practices facilitating disease spread and is more likely to contest control measures or complicate their implementation. Communication can be implemented by different means such as publications, leaflets, posters or through the media. In the absence of clear communication from the relevant authorities, different lobby groups can fill information gaps by introducing messages that benefit their own interests. Therefore, it was considered important to communicate a simple and clear message that includes the non-zoonotic nature of ASF, its global dimension, its epidemiology and ecology, the economic impact and the absence of treatment and vaccine. There was agreement on the need to involve communication experts in designing the messages, communication tools and strategies so that messages for stakeholders become as simple and practical as possible, and tailored for long-term application.

The risk of unintentional disease spread was considered high for people having intensive contacts with wild boar and domestic pigs (e.g. hunters and farmers). Therefore, an urgent need for a proactive approach was identified, including risk-oriented awareness campaigns. The groups also discussed and expressed consensus regarding the management of reports of clinical suspicions of ASF in wild boar arising from the field by a specific structure (e.g. a central emergency number, mobile phone application) that is continually available. There was consensus about emphasising the importance of establishing a task force

with defined responsibilities before ASF occurs in a country. This could include crisis management teams from domains other than the veterinary sector to achieve quick mobilisation of a workforce. It was stated that it would be beneficial to involve the experience and the knowledge of countries affected by ASF in the preparedness process.

Finally, there was a discussion around the habituation to the endemic disease situation which is likely to occur if the disease becomes endemic in a territory. In such cases, regular awareness campaigns and motivation incentives were considered necessary to maintain the involvement of stakeholders. In summary, there was a high level of consensus in this topic, especially concerning the urgent need to identify and involve all categories of stakeholders in the disease control activities and to develop proactive and risk-oriented awareness campaigns involving different disciplines, before and at all stages of the epidemic.

### 3.1.2. Fencing

In the discussions around this topic the participants found it necessary to distinguish between different kinds of physical barriers such as permanent or mobile fences and electric fences. This specification was considered relevant because of the specific technical characteristics and purposes of each particular type of fence. Electric fences were mentioned as being more efficient in deterring wild boar movements but requiring more maintenance and possibly having less social acceptance due to a perceived risk of electric shocks to humans and animals. In some instances, the use of fences was mentioned as being complementary to other population control methods (hunting or trapping). The efficiency of fences was considered to be variable, depending on the goal and the moment of their evaluation: if the aim is immediate restriction of wild boar movement to mitigate disease spread and give governments and administration time to react in connection to a focal introduction, then appropriate fencing might be effective. In such cases, responsiveness needs to be high and fences deployed quickly. However, if the aim is to stop spread of ASF in the long term, fencing is likely less efficient.

Participants further highlighted that the general public's acceptability of fences could vary depending on several aspects. The decision to fence a territory has high political impact and is often controversial because it can conflict with property laws and international biodiversity conservation treaties (e.g. reducing ecological connectivity and the functionality of wildlife corridors). Restricting pedestrians from entering fenced areas for recreational use increases the likelihood of protest and rejection of the implemented measures. Moreover, fences are expensive to build and maintain, while their efficiency for enhancing control of ASF in wild boar population is not guaranteed. Therefore, the media and the public can easily contest a fencing policy. In some cases, fences can even generate or increase diplomatic tensions between neighbouring countries or municipalities. Conversely, high media visibility can be used to increase public awareness of disease control and control area boundaries. Long-term measures to monitor ecological impact, plan maintenance and assess efficiency should be considered and requested from decision-makers in the case of long-term fencing policies.

In general, this topic generated highly contrasting opinions within and between groups. However, there was clear consensus that long-term fencing along national borders as well as large-scale fencing can be inefficient at preventing wild boar movements, and that these measures often are implemented for merely symbolic or political reasons. Finally, the groups discussed that high consideration should be given to maintenance costs and efforts when planning the construction of a fence, the later costs being proportional to the length and durability of the fence.

### 3.1.3. Passive surveillance

In all groups, the discussion started with finding a common definition of passive surveillance for the purpose of the discussion. There was agreement on the need to distinguish between “*routine* passive surveillance”, i.e. the reporting of wild boar found dead in the absence of a perceived risk of ASF, and “*enhanced* passive surveillance”, which is



implemented when ASF is already present in an area or in the direct neighbourhood. It was noted that in some countries the term passive surveillance could also include sampling or even removal of wild boar carcasses, in addition to reporting. There was controversy in the discussion about whether wild boar involved in road traffic accidents should be included in passive surveillance or only wild boar found dead without an obvious cause of death. Low natural wild boar mortality and the tendency of diseased animals to hide can considerably reduce the success of finding wild boar carcasses, and influence both the efficiency of passive surveillance and the motivation of the persons involved in the search. The groups discussed different options for increasing the acceptability, feasibility and efficiency of passive surveillance, such as voluntary hunters (paid or unpaid) searching for carcasses even during periods with low hunting activities. Other methods suggested were the provision/availability of easy-to-use sampling material and infrastructures for carcass disposal. Furthermore, good communication with stakeholders, the authorities and hunters, as well as transparent information directed at the public, was considered as being the most important and powerful tool for improving passive surveillance. Several aspects, which could decrease the willingness for, or feasibility of, effective passive surveillance, were also discussed. In many countries, hunters were asked to volunteer to search for carcasses. However, if this community did not see any advantage in reporting or taking samples from dead wild boar, passive surveillance would be difficult to implement successfully. In several countries, good communication and feedback to hunters was reported as being more motivational than other incentives in this regard. Motivating stakeholders with financial compensation was also discussed as having potentially adverse consequences on disease control because dead wild boar could be moved to infected areas deliberately. This would distort any surveillance data and imply a risk of spreading ASF. The benefit of financial incentives was also questioned due to low sustainability if the outbreak is not quickly resolved, and the disease becomes endemic. Indeed, most national administrations would not be able to maintain financial compensation over extended periods of time. Another identified potential constraint for the reporting of dead wild boar was the fear of subsequent consequences, such as declaring a hunting ground as an infected area and losing the benefits of paid hunts. Such a situation, might restrict the access of authorities to private land, thus reducing the effectiveness of passive surveillance.

Moreover, research gaps needing further studies were identified. These included the development of modelling approaches to identify environmental characteristics favouring the detectability of wild boar carcasses to help target surveillance efforts towards areas with a higher probability of carcass detection. Other measures with the same goal were also mentioned, such as the use of hunting dogs to improve carcass detection and smart phone technology to speed up reporting and storage of geographic information of carcass location data. Moreover, the need for evaluation of the effectiveness and sustainability of intensive passive surveillance efforts was highlighted. In summary, there was consensus on the importance of implementing wild boar passive surveillance activities, particularly for early detection of introductions and the subsequent potential deployment of contingency plans. However, the methods and ideas for improving the probability of wild boar carcass and disease detection differed between countries.

### 3.1.4. Manipulation of the carrying capacity of wild boar habitats

The discussion on carrying capacity (CC) was centred around two graphs created during the World Café, one of them displayed as Fig. 2. This graph represented the theoretical population dynamics over time at and around the CC of a habitat, and the potential drop in surviving wild boar after negative CC manipulation. The second graph (not shown) represented a spatial area affected by an outbreak. The total size of this area varied between the groups. The discussions around these graphs included how different habitat manipulations in the core area, buffer area or surrounding intensive hunting area might impact on population

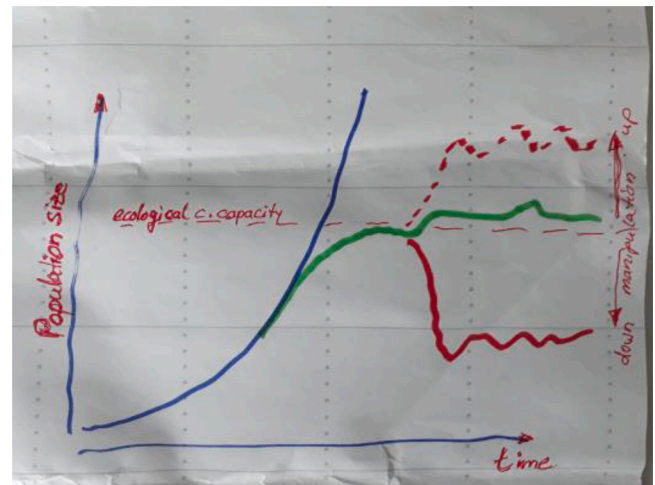


Fig. 2. Representation of theoretical population dynamics over time at and around the carrying capacity of a hypothetical habitat created during the discussions: The x-axis refers to symbolic time since the introduction of a wild boar population in a habitat area. The y-axis refers to the number of wild boar living in the habitat area. The blue line symbolises exponential growth, eventually leading to more animals than could sustain their needs in the habitat; the green line shows the population fluctuating by size around the number related to the carrying capacity; the red lines symbolise the alternative targets of manipulating carrying capacity e.g. by adding or removing feed sources.

density. The conceptualisation between participants was not univocal. During the discussion, the potential purposes of CC manipulations in wild boar habitats, the available tools to achieve CC manipulations, and some concerns related to the general idea of CC manipulation were addressed. The potential purposes of CC manipulation discussed were to reduce the survival time of the virus in a population, reduce the number of hosts, and fracture the populations and favour small-scale movements rather than long-distance migrations. Different tools to achieve CC manipulations were discussed and sorted into spatial manipulation of resource/needs (fencing off water and nutrition, manipulating agricultural harvests), reducing comfort (clearing away bushes, trees and shelter areas, stripping wetlands, burning habitats), altering mortality/survival (poisoning, fertility control, predators, hunting), and spatially structured nutrition (artificial feeding). In general, it was suggested that the effectiveness of CC manipulation was determined by the size of the habitat to be managed and the time horizon available to implement the habitat manipulations. The participants regarded 'incompatible time-scales' as the most recognised problem for the use of the ecological CC as a control option for ASF in wild boar, because most measures would require multiple generation times to become effective. Feed scarcity, for example, would be an achievable outcome of CC manipulations only in very limited parts of Europe. Consequently, it was agreed that CC manipulation might be difficult to implement as a reactive, spatially limited, emergency measure. The purposefulness of the measures was further discussed in relation to the waste of effort involved in performing disproportionate treatments (e.g. clearing bushes impacts the area for longer than the epidemic lasts). It was agreed that CC manipulation tools were unlikely to have an impact in the context of small-scale spatio-temporal outbreaks, as wild boar is a resistant species that is difficult to bring to the limit of resource needs. In large areas with a long-term horizon of manipulations, the sustainability of the approaches is most important due to imposed social and ecological conflicts. Measures proposed to manipulate the wild boar CC in larger habitat areas were always considered controversial due to anticipated negative interference with ecosystem services. This might relate to ecological complications (e.g. affecting other species, birds, trees, population genetics) and difficulties in adjusting manipulations to fluctuating natural resources (e.g. mast years). There was consensus about the need for coordination

among stakeholders who represent heterogeneous interests in an area, e.g. stakeholders with different agricultural traditions and practices. Specific management of CC to manipulate wild boar populations in small ASF-affected areas within a short timeframe was also discussed. Measures mentioned in that regard were keeping feed available by leaving agricultural crop fields unharvested, providing extra feed, and removing forage from the buffer area. There was a discussion that application of these measures requires a strong legal enforcement by the authorities because farmers will not be allowed to harvest their fields. In the Czech Republic, this method was considered to have had a positive effect on the reduction of movement of wild boar out of their home range areas, thus reducing the risk of further spread of the infection (Charvátová et al., 2019; Office National des Epizooties, 2019). The effect on population abundance in that country was considered slow and proportional to the mortality caused by the disease. It was concluded that habitat manipulation was considered acceptable by the general public and professionals, but encountered some resistance from local farmers directly affected by the restrictions.

In summary, it was agreed that reducing the CC might be difficult to implement as a reactive, short-term emergency measure, as in most areas there is no scarcity of feed for wild boar. Conversely, it was agreed that increasing the CC in a very small affected area (e.g. the core-area after a focal introduction) could decrease the risk of further spread of the infection from the core area as it may lead to reduced wild boar movements

### 3.1.5. Hunting management

All groups agreed on a temporal scenario described as “stop-search-think-do”, separating the measures to be implemented into different phases. In this context, there was a consensus on the fact that hunting to eradicate wild boar in the buffer and core areas (see Box 1) must be carried out according to a plan, agreed on with the stakeholders involved, and implemented in a way that prevents the outward movement of wild boar. Ideally, wild boar should be eliminated from the outside edge of the buffer towards the centre of the core area, whilst trying to achieve a good equilibrium between the greatest possible efficiency and the least possible disturbance of wild boar. Different hunting methods are possible such as individual hunting, drive hunts, hunting with dogs, and the use of night-vision devices. The choice can be influenced by local hunting traditions, the local habitat and the hunting objective (population reduction or elimination). The groups also concluded that the feasibility and efficacy of different hunting modalities and their effect on wild boar disturbance in different hunting grounds must be assessed in peacetime. Alternative methods for eradicating wild boar in the buffer and core areas were also discussed under this topic, including poisoning, trapping or fencing. For instance, an alternative fencing approach to direct wild boar movement towards a specific area was proposed based on the experience in Australia. In this approach, some one-way gates are left open in an otherwise fenced area, enabling wild boar to be driven into an area where they are easier to eliminate.

It was concluded that different hunting modalities can be used to achieve a substantial reduction in the local wild boar population. Some countries have reported greater efficiency by using drive hunts with dogs, while other countries have reported better efficiency with individual hunting. The efficiency will depend on the duration of the hunting activities (e.g. individual nightly hunting or three times per month drive hunts may have the same effect). Involving trained shooters (police and military snipers, specifically trained hunters) allowed to use special equipment such as night vision, thermal vision and silencers in affected areas was also discussed. According to the experience of the Czech Republic, these methods were considered effective and feasible, and with the advantage of having a limited effect on animal movement compared to regular hunting. The effectiveness can be increased further if performed at baiting sites or using attractants. The method was assumed to be well accepted by both the general public and

professionals, but its application in some countries might face legal constraints. The groups also discussed the use of camera trap networks to monitor populations and evaluate the efficiency of the implemented activities. Furthermore, the use of helicopters, drones or thermal cameras was proposed in open areas to localise remaining wild boar populations and target culling efforts.

In summary, despite divergent points of view due to different hunting traditions and experiences in a diversity of habitats, there was consensus in the fact that after a focal introduction of ASF, wild boar should be driven from the outside edge towards the centre of the affected area, where they are to be eliminated with the method providing the highest efficiency and the least possible disturbance.

### 3.1.6. Other population control methods

The methods discussed included the use of poison, fertility control, trapping and trained shooters. The results of the discussions on this topic are summarised in Table 3. As a starting point, the group suggested that the methods discussed should not be referred to as alternative but rather as complementary, given that they are not meant to substitute hunting as a population control method but to provide additional options. Moreover, it was concluded that several of the methods discussed are technically available, but are not yet currently applicable in the European context because they are controversial and politically sensitive (use of toxicants) or because they are not technically deployable at large scale or commercially available (use of contraceptives). Poisoning, i.e. culling by oral administration (through baits) of a toxic substance that causes quick death without suffering, is used in areas where wild boar or feral swine have been introduced and are considered an invasive species, such as in Australia or the USA. Technically, the method was considered feasible for application in restricted areas (possibly fenced) in emergency situations and for a short time period. Some countries might have the power to implement this measure under exceptional emergency situations, but culling with toxic substances was not considered an option at present for the control of wild boar populations (see Table 3). Considering the assumed negative perception of the application of this method among the general public as well as among professionals in Europe, the groups agreed that there is a need for additional risk assessment to evaluate the benefits and potential threats to the

**Table 3**

Summary of the conversation on “Other population control methods” during the World Café discussion.

Methods	Positive attribute	Negative attributes	Stakeholder acceptability
<b>Trapping</b>	Effectiveness varies between regions and seasons	Resource and labour intensive	General public: good Hunters: variable Other professionals: good
<b>Poisoning</b>	Effective, quick response	Technically feasible but currently not legal in the EU. Requires further scientific validation	General public: bad Hunters: bad Other professionals: variable
<b>Fertility control</b>	No adverse effects on animal welfare. Applicable in urban and inaccessible areas	Oral contraceptive not available for wild boar Potentially slow effect Impact on other species Food safety not evaluated	General public: good Hunters: variable Other professionals: variable
<b>Trained shooters</b>	Effective compared to regular hunting Limited effect on wild boar movement	Not applicable in urban areas	General public: good Hunters: good Other professionals: good

environment and to animal and human health. In particular, there is a lack of data on the potential threat to non-target animal species and possible environmental contamination. To increase acceptability, it was suggested that alternative expressions should be used in communication, such as “euthanasia” or “humane preventive destruction (culling) of the population”, and to improve communication regarding the purpose of the culling (to prevent animals with the disease from suffering) and the potential advantages (quick and humane action, no residues). Fertility control, i.e. decreasing the fecundity of female wild boar by administration of contraceptive medicines as a complementary method of population control, was assumed to be more ethically acceptable than culling by the use of toxic substances with no legal or political constraints to its application. However, such a product is not yet commercially available. Moreover, the consensus of the group was that the impact of the method would be too slow to reduce the population in an emergency situation within affected areas. Potentially, however, it could be used in buffer zones around affected areas, for preventive population reduction in free areas, and in areas where other measures are difficult to implement, for example in urban environments. However, the groups concluded that some concerns regarding the impact on non-target species and public health (unintentional exposure of humans) still need to be assessed.

The use of traps for catching wild boar at baiting sites followed by culling was generally considered a feasible method that has been applied with variable success in several countries and under different conditions. The advantages of using large traps designed for many animals at every catch were emphasised. The groups concluded that trapping of wild boar as an alternative population control method would allow high biosecurity levels as well as a higher level of animal welfare compared to the other methods discussed, and was thus assumed to be a method that would be accepted by the general public and professionals. Nevertheless, some hunters could oppose the concept of culling (i.e. shooting) trapped animals. The drawbacks mentioned were related to costs required in terms of time, effort and human resources, since traps need to be regularly monitored and maintained. It was also mentioned that the effectiveness may vary between regions and seasons.

Furthermore, the groups discussed using trained shooters and managing forage availability in affected areas as an alternative/complementary method. However, the aspects included in those discussions are covered in the hunting strategy and carrying capacity management sections and are therefore not repeated here. To summarize, despite being resource intensive and contested by some hunters, trapping of wild boar was considered a good complementary population control method compatible with biosecurity and animal welfare requirements. Despite proven efficiency in experimental or other contexts, population control methods such as poisoning and fertility control remain controversial, politically sensitive, or require additional research before they can be deployed at a large scale in the European context.

### 3.2. The World Café method

In summary, the World Café method was perceived as suitable for reaching the objectives of this study. Key qualities of the method put forward by previous practitioners such as stimulating collective intelligence (MacFarlane et al., 2017), allowing creativity and the emergence of new ideas (Steier et al., 2016) as well as reducing felt presence of hierarchical structures (Tan and Brown, 2005) were indeed observed, and its ability to increase the level of participation confirmed. Further, the rotating format and the small discussion groups that were kept fixed throughout the exercise seemed to allow participants to express themselves with transparency and trust, and to enable the participants to evolve together as a group. This adaption of the World Café method has been used before (MacFarlane et al., 2017), whereas others promote a more informal set up with new groups forming spontaneously during the exercise (Fouché and Light, 2011). In our experience, keeping the same groups during all rotations reinforced a collaborative spirit that

encouraged active participation and had a positive effect on the working atmosphere. This constructive atmosphere was observed in the creation of operational solutions, for example illustrated in the graphs (Fig. 2) to conceptualize the problem and its potential solutions. Conversations were generally fluent and intensive, with a high level of exchange between countries and disciplines despite some of the topics proving controversial. Some participants from affected countries said that they felt the World Café method was a useful process for being confronted with different or new approaches to address similar challenges. Meanwhile, some participants from unaffected countries highlighted the exercise as particularly beneficial, exposing the diversity and variety of wild boar management measures that need to be implemented to manage ASF. Country and discipline diversity allowed a rich level of exchange. The World Café method is often described to promote learning from each other and to create collective intelligence (Brown and Issacs, 2010). In that respect, participants involved in disease control appreciated the professional exchange with wildlife managers and conversely wildlife professionals appreciated learning more on the epidemiological aspects of the disease. Similarly, contrasting field management experiences with different wild *Suidae* populations such as wild boar in Europe and feral pigs in Australia was considered an added value of the discussions.

In general, there were varying viewpoints within and between groups, indicating that many of the methods discussed triggered contrasting opinions and discussions. Using the World Café method, this diversity of opinion could be captured without striving for consensus to be reached. Striving for consensus or even forcing it, have been an element of critique put forward against the way group interviews or focus group discussions have been employed in participatory epidemiology (Chenais and Fischer, 2018). Even in groups that are constructed to be homogenous (which was not the case in this study) a certain level of diversity will always be present (Ebata et al., 2020; Fischer et al., 2020). If consensus is sought for, this diversity in opinion and experiences will be lost, and especially weaker voices might not be heard.

The three dimensions of evaluation of the different topics are summarised in Table 4. Some of the control methods and topics addressed were particularly controversial, especially those including ethical judgements related to wild boar population control methods or to the building and impact of fences (see Table 4). Conversely, a high level of consensus was expressed about passive surveillance and stakeholder communication. Some conflict between practical experience and theoretical knowledge was present in all topics. The level of dissensus, consensus and the saturation level varied between the topics (see Table 4).

## 4. Discussion

As the related Appreciative Inquiry method (Egan and Lancaster, 2005), the World Café method traditionally focuses on promoting positive examples of solutions and producing constructive change, whereas other methods within the common field of Participatory Action Research

**Table 4**

Appreciation of the different topics based on the level of dissensus, consensus and saturation during the World Café discussion (Null = 0, Low=+, Medium=++, High=+++).

Topic	Dissensus	Consensus	Saturation
Stakeholder engagement and public awareness	0	++	+
Fencing	+++	+/**	+
Passive surveillance	+	+	++
Manipulation of carrying capacity	++	+	++
Hunting management	*	*	*
Other population control methods	++	+	++

\*Data were not recorded for this topic.

\*\* This refers to the inefficiency of long fences/political impact).



(participatory epidemiology included) focuses more on finding solutions to problems (Aldred, 2011). In this study, however, the World Café method efficiently framed problems within the different topics, and especially served to make the complexity of these problems tangible. Further, and as mentioned by Aldred (2011), the method served to create understanding rather than confronting different opinions or counterparts. These are some of the key qualities of the World Café method, previously mentioned in the literature and observed in this study. In this regard, it might be relevant to mention that in our study many of the participants of different disciplines and backgrounds did not know each other before the meeting. Thus, the opportunity for interest groups or individuals to impose a specific agenda or point of view was limited. This aspect has been reported as a problem from discussions at for example open community meetings (Carson, 2011). The fact that the meeting was organised by a networking project linked to ASF control could further have contributed to the perceived sense of neutrality, transparency and trust that facilitated open communication. In that sense, the mixed groups facilitated the flow of information and exchange of views between disciplines in a cumulative, non-hierarchical process. Keeping the same groups throughout the exercise contributed to the desired informal discussion climate. This adoption of the original World Café method promoted inclusive participation and stimulated bridging of communication barriers that can otherwise be observed in multi-stakeholder and transdisciplinary discussions (Bagnol et al., 2016; Norris et al., 2016). In this study, the observed high level of participation were crucial for the quality of the end results, with the integration of views from varied stakeholders contributing to the scientific quality of the outcome concerning general priorities, knowledge gaps and recommendations in the field of wild boar management and ASF control. This ability of the method to harvest multiple opinions, without prioritising or striving for consensus has indeed been put forward as one of its strengths (Fouché and Light, 2011), compared to other participatory methods that often strive for consensus, thus failing to account for all voices (Campbell, 2002). Nevertheless, critiques have been raised arguing that the World Café (and Appreciative Inquiry) methods might actually conceal disagreements, especially if discussions are undertaken in contexts that have power inequalities (Aldred, 2011). Contrary to such critique, in this study different solutions to the same problems were frequently voiced, and it was noted that the varied stakeholders involved in wild boar management or ASF control had different professional objectives. This application of the World Café method thus efficiently dealt with the challenge of finding a trade-off between different visions and needs. An interesting outcome of this dynamic was the production of a harmonised panel of definitions for terms that do not always have the same meaning in different countries or expert fields.

Biases might be introduced at every step in the research process, from acquiring funding to study design and participants selection, data collection, analysis and publication of the results (Galdas, 2017). In our study, one of the potential biases was the facilitators and how they were selected (Bedelian et al., 2007; Fischer et al., 2020). The original World Café format<sup>3</sup> does not include pre-selected facilitators but let the groups themselves distribute the roles among the participants. We, however, hypothesized that it would be relevant especially for the second objective of our study ("to gather knowledge concerning the control of ASF in wild boar populations and assess the efficiency and applicability of different control methods") that the facilitators had good knowledge of the topic they were facilitating, and that their expertise would be useful for guiding the discussions and ensuring progress. These aspects, together with facilitation skills and interest in the method, thus guided the selection of facilitators. The facilitators' previous knowledge could however have influenced the power relations between the facilitators and the participants (Galdas, 2017), how discussions were engaged, and what aspects that were put forward in each topic. The extent of this

potential bias cannot be assessed. Further supporting the use of pre-selected facilitators, however, MacFarlane et al. (2017) point out that skilled facilitators are able to pick up and react to group dynamics in ways that layman café or table hosts might not be.

The issue of communication among and between stakeholders seems to be both difficult and essential in the context of disease crisis management (Sell, 2017). This aspect was repeatedly mentioned as a challenge for all topics, and the importance of delivering adapted key messages to targeted stakeholders was consensual. Another aspect that transpired from the conversations was the challenge of keeping stakeholder motivation high over time if the disease becomes endemic. An additional constraint concerns the participation of hunters in activities aimed at controlling ASF: it seems obvious to involve hunters in the management of their resource, but if the management activity consists of drastically reducing the wild boar population size or requesting other services such as carcass disposal and sampling, it might become difficult to maintain motivation and engagement. Further efforts are needed to improve communication with the hunting community and increase understanding of their views to enhance their integration in disease management activities. Fencing has been used successfully in the Czech Republic to control and eradicate a focal introduction of ASF in a wild boar population (Charvátová et al., 2019). Since then, several countries have promoted fencing to prevent the introduction of ASF in their territory from neighbouring countries or to contain the spread (Mysterud and Rolandsen, 2019; Dellicour et al., 2020). One of the World Café outputs was tangible scepticism about the current efforts of many EU countries to fence large perimeters of their borders to prevent transboundary ASF spread in light of their ecological impact and maintenance costs (Woodroffe et al., 2014; Mysterud and Rolandsen, 2019).

Considering the progress of ASF and the high densities of wild boar populations in some areas of the EU (Melis et al., 2006), it seems a matter of urgency to test different options for reducing population densities. In the light of the conclusions from this study, intensive hunting methods are considered effective and feasible, but have a more limited effect on animal movement compared to regular hunting. Furthermore, to improve efficiency they should, when possible, be combined with other possible control methods, such as fencing and trapping. The potential use of alternative methods to reduce wild boar populations in localised emergency situations, such as chemical culling (Snow et al., 2016, 2017) or fertility control (Massei et al., 2011), should be investigated from a legal, environmental, animal welfare and oral administration perspectives (Ferretti et al., 2018).

## 5. Conclusions

Despite intensive efforts to control ASF in wild boar populations, the disease continues to spread to new territories. The complex epidemiology of ASF in wild boar necessitates the involvement of diverse stakeholders and different scientific disciplines to achieve sustainable control. The studied application of the World Café method showed comparative discussion advantages such as the production of concrete outputs and the creation of an inclusive discussion climate promoting active participation that allowed open-minded appraisal of the control methods. The importance of coordination and communication within and between different stakeholders during the preparation as well as implementation phases of disease control was highlighted. Therefore, based on the results from this study, we recommend the use of the World Café method for discussions in multinational and/or multidisciplinary fora in the context of ASF and other animal health crises.

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<sup>3</sup> <http://www.theworldcafe.com/>.



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